

AMENDMENTS TO THE CLAIMS

1. (Currently amended) ~~An image encoding method characterized by comprising the steps of:~~

~~—generating a transformation coefficient transforming an image from a spatial domain into a frequency domain; and quantizing the transformation coefficient by using the same quantization width as that at the time of decoding with a quantization characteristic different from a quantization characteristic at the time of decoding.~~

An image encoding method which comprises the step of generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, characterized by comprising the step of quantizing the plurality of transformation coefficients for each block by using the same quantization width, wherein the step of quantizing comprises the step of quantizing the transformation coefficient upon setting a dead zone for each block.

2. (Canceled).

3. (Currently amended) ~~An image encoding method according to claim 2, characterized by further comprising the step of setting a dead zone width.~~

An image encoding method according to claim 1, characterized in that the step of quantizing the transformation coefficient upon setting the dead zone comprises the step of setting a dead zone width corresponding to a visual sensitivity for each block.

4. (Currently amended) ~~An image encoding method according to claim 3, characterized in that the step of setting the dead zone width comprises the step of setting the dead zone width for said each transformation coefficient.~~ An image encoding method according to claim 3, characterized in that the step of setting the dead

zone width corresponding to the visual sensitivity comprises the step of setting the dead zone width to a larger width for a block with lower visual sensitivity in the spatial domain.

5. (Currently amended) An image encoding method according to claim 3, characterized in that ~~the step of setting the dead zone width comprises the step of, when a set of blocks each including a plurality of transformation coefficients as constituent elements are to be quantized with the same quantization width, setting the dead zone width for said each block~~ the step of setting the dead zone width corresponding to the visual sensitivity comprises the step of setting a dead zone width larger than a dead zone width with a predetermined quantization characteristic to a block with lower visual sensitivity in the spatial domain.

6. (Currently amended) An image encoding method according to claim 3, characterized in that ~~the step of setting the dead zone width comprises the step of adaptively changing the dead zone width~~ the step of setting the dead zone width corresponding to the visual sensitivity comprises the steps of analyzing visual sensitivities of a plurality of blocks, and setting the dead zone width to a larger width for a block with lower visual sensitivity of the plurality of blocks.

7. (Currently amended) ~~An image encoding method according to claim 4, characterized in that the step of setting the dead zone width comprises the step of setting the dead zone width to a smaller width for a transformation coefficient with higher visual sensitivity in a frequency domain, and setting the dead zone width to a larger width for a transformation coefficient with lower visual sensitivity in a frequency domain.~~ An image encoding method according to claim 3, characterized in that the

step of setting the dead zone width corresponding to the visual sensitivity comprises the steps of analyzing visual sensitivities of a plurality of blocks, and setting a dead zone width larger than a dead zone width with a predetermined quantization characteristic to a block with lower visual sensitivity of the plurality of blocks.

8. (Currently amended) ~~An image encoding method according to claim 5, characterized in that the step of setting the dead zone width comprises the step of setting the dead zone width to a smaller width for a block with higher visual sensitivity in a spatial domain, and setting the dead zone width to a larger width for a block with lower visual sensitivity in a spatial domain.~~ An image encoding method which comprises the step of generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, characterized by comprising the step of quantizing the plurality of transformation coefficients for each block upon setting the same quantization width in the plurality of blocks, wherein the step of quantizing comprises the steps of analyzing visual sensitivities of the plurality of blocks, determining the quantization width in accordance with a block exhibiting high visual sensitivity, setting a dead zone width larger than a dead zone width of the block exhibiting high visual sensitivity to a block with lower visual sensitivity, and quantizing the transformation coefficient.

9. (Currently amended) ~~An image encoding method according to claim 6, characterized in that the step of changing the dead zone width comprises the step of adaptively changing the dead zone width in accordance with a flatness of the image.~~ An image encoding method according to claim 8, characterized by further comprising the step of calculating the dead zone width from at least one of a prediction mode of the image, a direction of intra frame prediction of the image, motion of the image, a

direction of inter frame prediction of the image, an average absolute error of the image, a variance of the image, an image range of the image, an average absolute error of a prediction error signal of the image, and a variance of a prediction error signal of the image.

10. (Currently amended) ~~An image encoding method according to claim 9, characterized by further comprising the step of calculating a flatness of the image from at least one of a prediction mode of the image, a direction of intra frame prediction of the image, motion of the image, a direction of inter frame prediction of the image, an average absolute error of the image, a variance of the image, a difference between a maximum value and minimum value of the image, an average absolute error of a prediction error signal of the image, and a variance of a prediction error signal of the image.~~ An image encoding method according to claim 8, characterized by further comprising the step of calculating the dead zone width from one of a minimum value of an average absolute error of each of a target block and a neighboring block, a minimum value of a variance of the image of each of the target block and the neighboring block, and a minimum value of an image range of the image of each of the target block and the neighboring block.

11. (Currently amended) ~~An image encoding method according to claim 3, characterized in that the step of setting the dead zone width comprises the step of obtaining the dead zone width from a relationship between an ideal quantization width and a real quantization width.~~ An image encoding method which comprises the step of generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, characterized by comprising the steps of calculating an ideal quantization parameter for encoding an input moving

image with preferable image quality, evaluating a relationship between a quantization width corresponding to the ideal quantization parameter, and a quantization width corresponding to a quantization parameter used for encoding output, and quantizing the transformation coefficient upon setting the dead zone width in correspondence with the evaluated relationship.

12. (Currently amended) ~~An image encoding device characterized by comprising:~~

~~—— transformation means for generating a transformation coefficient by transforming an image from a spatial domain into a frequency domain; and~~

~~—— quantization means for quantizing the transformation coefficient by using the same quantization width as that at the time of decoding with a quantization~~

~~characteristic different from a quantization characteristic at the time of decoding. An image encoding apparatus which comprises transformation means for generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, characterized by comprising~~

~~—— quantization means for quantizing the plurality of transformation coefficients for each block by using the same quantization width,~~

~~—— wherein said quantization means comprises means for quantizing the transformation coefficient upon setting a dead zone for each block.~~

13. (Canceled)

14. (Currently amended) ~~An image encoding device according to claim 13, characterized by further comprising dead zone generating means for setting a dead~~

~~zone width in said quantization means.~~ An image encoding apparatus according to claim 12, characterized by further comprising dead zone generating means for setting a dead zone width corresponding to a visual sensitivity for each block.

15. (Currently amended) ~~An image encoding device according to claim 14, characterized in that said dead zone generating means comprises dead zone scale generating means for setting the dead zone width for said each transformation coefficient.~~ An image encoding apparatus according to claim 14, characterized in that said dead zone generating means comprises dead zone scale generating means for setting the dead zone width to a larger width for a block with lower visual sensitivity in the spatial domain.

16. (Currently amended) ~~An image encoding device according to claim 14, characterized in that said dead zone generating means comprises dead zone scale generating means for, when said quantization means quantizes a set of blocks each including a plurality of transformation coefficients as constituent elements with the same quantization width, setting the dead zone width for said each block.~~ An image encoding apparatus according to claim 14, characterized in that said dead zone generating means comprises dead zone scale generating means for setting a dead zone width larger than a dead zone width with a predetermined quantization characteristic to a block with lower visual sensitivity in the spatial domain.

17. (Currently amended) ~~An image encoding device according to claim 14, characterized in that said dead zone generating means comprises dead zone scale generating means for adaptively changing the dead zone width.~~ An image encoding apparatus according to claim 14, characterized in that said dead zone generating means

comprises dead zone scale generating means for analyzing visual sensitivities of a plurality of blocks, and setting the dead zone width to a larger width for a block with lower visual sensitivity of the plurality of blocks.

18. (Currently amended) ~~An image encoding device according to claim 15, characterized in that said dead zone scale generating means comprises means for setting the dead zone width to a smaller width for a transformation coefficient with higher visual sensitivity in a frequency domain, and setting the dead zone width to a larger width for a transformation coefficient with lower visual sensitivity in a frequency domain.~~ An image encoding apparatus according to claim 14, characterized in that said dead zone generating means comprises dead zone scale generating means for analyzing visual sensitivities of a plurality of blocks, and setting a dead zone width larger than a dead zone width with a predetermined quantization characteristic to a block with lower visual sensitivity of the plurality of blocks.

19. (Currently amended) ~~An image encoding device according to claim 16, characterized in that said dead zone scale generating means comprises means for setting the dead zone width to a smaller width for a block with higher visual sensitivity in a spatial domain, and setting the dead zone width to a larger width for a block with lower visual sensitivity in a spatial domain.~~ An image encoding apparatus which comprises transformation means for generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, characterized by comprising quantization means for quantizing the plurality of transformation coefficients for each block upon setting the same quantization width in the plurality of blocks, wherein said quantization means comprises dead zone generating means for analyzing visual sensitivities of the plurality

of blocks, determining the quantization width in accordance with a block exhibiting high visual sensitivity, setting a dead zone width larger than a dead zone width of the block exhibiting high visual sensitivity to a block with lower visual sensitivity, and quantizing the transformation coefficient.

20. (Currently amended) ~~An image encoding device according to claim 17, characterized in that said dead zone scale generating means comprises means for adaptively changing the dead zone width in accordance with a flatness of the image.~~ An image encoding apparatus according to claim 19, characterized in that said dead zone generating means further comprises dead zone scale generating means for calculating the dead zone width from at least one of a prediction mode of the image, a direction of intra frame prediction of the image, motion of the image, a direction of inter frame prediction of the image, an average absolute error of the image, a variance of the image, an image range of the image, an average absolute error of a prediction error signal of the image, and a variance of a prediction error signal of the image.

21. (Currently amended) ~~An image encoding device according to claim 20, characterized by further comprising means for calculating a flatness of the image from at least one of a prediction mode of the image, a direction of intra frame prediction of the image, motion of the image, a direction of inter frame prediction of the image, an average absolute error of the image, a variance of the image, a difference between a maximum value and minimum value of the image, an average absolute error of a prediction error signal of the image, and a variance of a prediction error signal of the image.~~ An image encoding apparatus according to claim 19, characterized in that said dead zone generating means further comprises dead zone scale generating means for calculating the dead zone width from one of a minimum value of an average absolute

error of each of a target block and a neighboring block, a minimum value of a variance of the image of each of the target block and the neighboring block, and a minimum value of an image range of the image of each of the target block and the neighboring block.

22. (Currently amended) ~~An image encoding device according to claim 14, characterized in that said dead zone generating means comprises dead zone scale generating means for obtaining the dead zone width from a relationship between an ideal quantization width and a real quantization width.~~ An image encoding apparatus which comprises transformation means for generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, characterized by comprising quantization control means for calculating an ideal quantization parameter for encoding an input moving image with preferable image quality, dead zone scale generating means for evaluating a relationship between a quantization width corresponding to the ideal quantization parameter, and a quantization width corresponding to a quantization parameter used for encoding output, and quantization means for quantizing the transformation coefficient upon setting the dead zone width in correspondence with the evaluated relationship.

23. (Currently amended) ~~An image encoding control program characterized by causing a computer to function as transformation means for generating a transformation coefficient by transforming an image from a spatial domain into a frequency domain, and~~
~~—— quantization means for quantizing the transformation coefficient by using the same quantization width as that at the time of decoding with a quantization characteristic different from a quantization characteristic at the time of decoding.~~ An

image encoding control program characterized by causing a computer to function as transformation means for generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, quantization means for setting a dead zone for each block, and quantizing the plurality of transformation coefficients for each block by using the same quantization width.

24. (Canceled).

25. (Currently amended) ~~An image encoding control program according to claim 24, characterized in that the computer is caused to function as dead zone generating means for setting a dead zone width in the quantization means.~~ An image encoding control program according to claim 23, characterized by causing the computer to function as dead zone generating means for setting a dead zone width corresponding to a visual sensitivity for each block.

26. (Currently amended) ~~An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for setting the dead zone width for said each transformation coefficient.~~ An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for setting the dead zone width to a larger width for a block with lower visual sensitivity in the spatial domain.

27. (Currently amended) ~~An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for, when the quantization means quantizes a set of blocks each~~

~~including a plurality of transformation coefficients as constituent elements with the same quantization width, setting the dead zone width for said each block. An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for setting a dead zone width larger than a dead zone width with a predetermined quantization characteristic to a block with lower visual sensitivity in the spatial domain.~~

28. (Currently amended) ~~An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for adaptively changing the dead zone width. An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for analyzing visual sensitivities of a plurality of blocks, and setting the dead zone width to a larger width for a block with lower visual sensitivity of the plurality of blocks.~~

29. (Currently amended) ~~An image encoding control program according to claim 26, characterized in that the dead zone scale generating means comprises means for setting the dead zone width to a smaller width for a transformation coefficient with higher visual sensitivity in a frequency domain, and setting the dead zone width to a larger width for a transformation coefficient with lower visual sensitivity in a frequency domain. An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for analyzing visual sensitivities of a plurality of blocks, and setting a dead zone width larger than a dead zone width with a predetermined quantization characteristic to a block with lower visual sensitivity of the plurality of blocks.~~

30. (Currently amended) ~~An image encoding control program according to claim 27, characterized in that the dead zone scale generating means comprises means for setting the dead zone width to a smaller width for a block with higher visual sensitivity in a spatial domain, and setting the dead zone width to a larger width for a block with lower visual sensitivity in a spatial domain.~~ An image encoding control program characterized by causing a computer to function as transformation means for generating a transformation coefficient for each block by transforming an image from a spatial domain into a frequency domain for each block, quantization means for setting a dead zone, and quantizing the plurality of transformation coefficients for each block by using the same quantization width, and dead zone generating means for analyzing visual sensitivities of the plurality of blocks, determining the quantization width in accordance with a block exhibiting high visual sensitivity, and setting a dead zone width larger than a dead zone width of the block exhibiting high visual sensitivity to a block with lower visual sensitivity.

31. (Currently amended) ~~An image encoding control program according to claim 28, characterized in that the dead zone scale generating means comprises means for adaptively changing the dead zone width in accordance with a flatness of the image.~~ An image encoding control program according to claim 30, characterized in that the dead zone generating means further comprises dead zone scale generating means for calculating the dead zone width from at least one of a prediction mode of the image, a direction of intra frame prediction of the image, motion of the image, a direction of inter frame prediction of the image, an average absolute error of the image, a variance of the image, an image range of the image, an average absolute error of a prediction error signal of the image, and a variance of a prediction error signal of the image.

32. (Currently amended) ~~An image encoding control program according to claim 31, characterized in that the computer is caused to function as means for calculating a flatness of the image from at least one of a prediction mode of the image, a direction of intra frame prediction of the image, motion of the image, a direction of inter frame prediction of the image, an average absolute error of the image, a variance of the image, a difference between a maximum value and minimum value of the image, an average absolute error of a prediction error signal of the image, and a variance of a prediction error signal of the image.~~ An image encoding control program according to claim 30, characterized in that the dead zone generating means further comprises dead zone scale generating means for calculating the dead zone width from one of a minimum value of an average absolute error of each of a target block and a neighboring block, a minimum value of a variance of the image of each of the target block and the neighboring block, and a minimum value of an image range of the image of each of the target block and the neighboring block.

33. (Currently amended) ~~An image encoding control program according to claim 25, characterized in that the dead zone generating means comprises dead zone scale generating means for obtaining the dead zone width from a relationship between an ideal quantization width and a real quantization width.~~ An image encoding control program characterized by causing a computer to function as transformation means for generating a transformation coefficient for each block by transforming an input moving image from a spatial domain into a frequency domain for each block, quantization control means for calculating an ideal quantization parameter for encoding the input moving image with preferable image quality, dead zone scale generating means for evaluating a relationship between a quantization width corresponding to the ideal quantization parameter, and a quantization width corresponding to a quantization

parameter used for encoding output, and quantization means for quantizing the transformation coefficient upon setting the dead zone width in correspondence with the evaluated relationship.